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### **Program Description**

Modern chemistry occupies a central position among the sciences. The goal of chemical science is to discover the fundamental regularities by which matter in its multitude of aggregations interacts with energy in its many forms. Mathematical models and physical principles are utilized in the interpretation of chemical concepts. The organization of chemical knowledge leads to an understanding of natural phenomena in the real world of earth and life sciences.

The departmental academic program is designed to provide essential preparation for students to pursue professional careers and/or advanced studies in chemistry or related disciplines, such as Agricultural Chemistry, Biochemistry, Clinical Chemistry, Environmental Chemistry, and Forensics Chemistry. The department offers course work for chemistry majors to meet the requirements of medical and other professional schools in the health sciences, including dentistry, pharmacy, and veterinary medicine. It also cooperates with other departments and the School of Education in developing a balanced program of academic and professional preparation for chemistry majors who seek teaching credentials.

The Department of Chemistry is on the approved list of the American Chemical Society. A program leading to the chemistry major can be designed to meet the standards prescribed for the certificate of the American Chemical Society by its Committee on Professional Training.

### **Requirement for the Major in Chemistry**

The Bachelor of Science degree in Chemistry requires thirteen courses in chemistry, including the following (or the equivalent):

1. CHEM 211, 212, 213, 350, 390 and 490.
2. Seven additional upper division courses in chemistry (one upper division course in related disciplines may be substituted, with approval of academic advisor).
3. Cognate areas:
  - a. MATH 201, 202, 203
  - b. PHYS 201, 202, 203 or PHYS 221, 222, 223

### **Requirement for the Major in Chemistry with a Concentration in Biochemistry**

1. The following courses in chemistry (or the equivalent): CHEM 211, 212, 213, 331, 332, 340, 350, 351, 353, 390, 440, and 490.
2. Four of the following courses in Biology: Two courses selected from BIOL 201, 202 or 203 and two courses selected from BIOL 304, 312, 355, 430 or 462.
3. Cognate areas:
  - a. MATH 201, 202, 203
  - b. PHYS 201, 202, 203 or PHYS 221, 222, 223

### **Requirement for the Major in Chemistry Certified by the American Chemical Society**

1. The following courses in chemistry (or the equivalent): CHEM 211, 212, 213, 331, 332, 333, 350, 351, 352, 353, 390, 400, 450 and 490.
2. Two other upper division chemistry courses selected in consultation with academic advisor from CHEM 340, 440, 477 or 480.

3. Cognate areas:
  - a. MATH 201, 202, 203
  - b. PHYS 201, 202, 203 or PHYS 221, 222, 223

### **Requirements for the Minor in Chemistry**

Although no minor is required for the BS degree, a minor in chemistry is available, consisting of 20 units, 10 of which must be in upper division courses.

### **Teaching Credential: Science Teacher Preparation Program Leading to a Degree in Natural Sciences, Primary Concentration in Chemistry**

The California Commission on Teacher Credentialing (CCTC) has authorized CSUB to offer a single subject matter preparation program in Natural Sciences leading to a Bachelor of Arts degree. This course work satisfies the subject matter requirements for a "Secondary Teaching Credential in Science." The program consists of three components: I. Primary Concentration (major); II. Secondary Concentration (minor); and III. Breadth (cognates). Program completion leads to a BA degree in Natural Sciences with a major in the area of primary concentration and a minor in the secondary concentration. Additional information may be obtained from the Chemistry Department office (661-654-3027).

For a detailed description of the course requirements, please turn to the Natural Sciences section in this catalog.

### **Academic Regulations**

A grade of "C-" in chemistry as well as cognate courses is the minimal grade acceptable for progression into subsequent chemistry courses. Students who fail to achieve at least a "C-" or above may repeat the course. If a course is satisfactorily completed, the prior unsatisfactory grade will no longer bar a student from continuing in the Chemistry program although it will still be counted in computing the overall grade point average.

## **COURSE DESCRIPTIONS**

### ***Lower Division***

#### **CHEM 100A Chemistry in Your Life (5)**

A general education course introducing basic concepts of chemistry to the non-science major. The course focuses on the impact of chemistry on daily activities including environmental and other societal concerns. Two lectures, one discussion and one laboratory. Not acceptable for the major.

#### **CHEM 100B CSI: Crime Scene Investigation Chemistry (5)**

A general education course introducing basic concepts of chemistry to the non-science major using examples from forensic science. The course focuses on the use of crime-scene case studies, Sherlock Homes stories, and true accounts of drug deals, murders, and thefts to introduce chemical principles. Two lectures, one discussion and one laboratory. Not acceptable for the major.

#### **CHEM 100C Chemistry and the Environment (5)**

A general education course introducing basic concepts of chemistry to the non-science major using examples from environmental studies. The course focuses on the use of global warming studies, ozone hole studies, and accounts of the environmental impact of chemistry to introduce chemical principles. Two lectures, one discussion and one laboratory. Not acceptable for the major.

**CHEM 100D Chemistry of Beer and Wine (5)**

A general education course introducing basic concepts of chemistry to the non-science major using examples from the beer and wine industries. The course focuses on the use of the processes of beer brewing and wine making to introduce chemical principles. Two lectures, one discussion and one laboratory. Not acceptable for the major.

**CHEM 101 Preparation for College Chemistry (4)**

A one-quarter course based on a systematic, semi-empirical approach to the submicroscopic world of chemistry. The development of modern ideas concerning atomic and molecular structure, principles of compound formation, and chemical reactivity will be emphasized. Emphasis will be on the development of the skills necessary for success in chemistry. Science majors should consult with their advisors before enrolling in this course. Three lectures, one discussion.

**CHEM 150 General, Organic and Biochemistry I (5)**

Basic principles of chemistry including the composition of matter, periodic properties, chemical bonding and solution equilibria are introduced using examples from biological systems. Two lectures, one discussion and two laboratories. Not acceptable to the major.

**CHEM 203 General, Organic and Biochemistry II (5)**

Descriptive chemistry of carbon compounds including structure, reactivity and mechanism. Major focus is on organic compounds of biological and physiological importance as well as metabolism. Prerequisite: CHEM 150 or equivalent within the past five years. Two lectures, one discussion and two laboratories. Not acceptable to the major.

**CHEM 211 Principles of General Chemistry I (5)**

Introduction to atomic structure, quantum theory, periodic properties, chemical reactions, stoichiometry, gas laws and theories, molecular structure and bonding, states of matter, solutions, acids and bases, chemical equilibrium, thermodynamics, oxidation-reduction, electro-chemistry, chemical kinetics, nuclear chemistry, organic chemistry, descriptive chemistry, and coordination chemistry. Prerequisites: Math 85 or equivalent and a satisfactory score on the Chemistry Placement Test or CHEM 101. Two lectures, one discussion and two laboratories. (CHEM 211 + 212 + 213 = CAN CHEM SEQ A)

**CHEM 212 Principles of General Chemistry II (5)**

A continuation of CHEM 211. Prerequisite: CHEM 211 or equivalent. Two lectures, one discussion and two laboratories (CHEM 211 + 212 + 213 = CAN CHEM SEQ A)

**CHEM 213 Principles of General Chemistry III (5)**

A continuation of CHEM 212. Prerequisite: CHEM 212 or equivalent. Two lectures, one discussion and two laboratories (CHEM 211 + 212 + 213 = CAN CHEM SEQ A)

**CHEM 277 Special Topics in Chemistry (1 – 5)**

Topics and prerequisites to be announced. May be repeated for different topics.

**CHEM 281 Problem Solving in Chemistry (1)**

This workshop is designed for students in the Louis Stokes Alliance for Minority Participation Program (LSAMP), but is open to other students as well. It covers topics from CHEM 211, 212, 213. Typically, students work during the meeting on problems related to their class, being helped by a facilitator.

***Upper Division*****CHEM 310 Concepts of Geochemistry (5)**

Distribution of elements within the earth, their mobilities and interactions during crustal processes. Methods of investigation, application to geologic and environmental studies and petroleum and minerals exploration. Field and laboratory investigations and presentations. Same as GEOL 310. Prerequisites: CHEM 213, GEOL 303 or CHEM 351 and some geology course work. (Recommended: MATH 202) A field trip may be required. Consult the Course Schedule for specific details.

**CHEM 331 Concepts of Organic Chemistry I (5)**

A detailed study of the structure and reactivity of organic compounds. Prerequisite: CHEM 213 or equivalent. Two lectures, one discussion and two laboratories.

**CHEM 332 Concepts of Organic Chemistry II (5)**

A continuation of CHEM 331. Prerequisite: CHEM 331 or equivalent. Two lectures, one discussion and two laboratories.

**CHEM 333 Concepts of Organic Chemistry III (5)**

A continuation of CHEM 332. Prerequisite: CHEM 332 or equivalent. Two lectures, one discussion and two laboratories.

**CHEM 340 Concepts of Biochemistry (5)**

Biochemical equilibria and thermodynamics, biologically important chemical compounds, metabolism of carbohydrates, fats and proteins. Prerequisite: CHEM 332 or equivalent. Two lectures, one discussion and two laboratories.

**CHEM 350 Quantitative Analytical Chemistry (5)**

The practice and theory of chemical laboratory methods including techniques of gravimetric, volumetric, spectrophotometric analysis and separation, and introductory instrumental analysis with a focus on precision and accuracy of experimental data. Prerequisite: CHEM 213 or equivalent. Two lectures, one discussion and two laboratories.

**CHEM 351 Concepts of Physical Chemistry I (5)**

Introduction to chemical thermodynamics, properties of solutions, phase equilibria and electrochemistry. Prerequisites: MATH 201, PHYS 201 and CHEM 213. Two lectures, one discussion and two laboratories.

**CHEM 352 Concepts of Physical Chemistry II (5)**

Introduction to quantum chemistry, atomic and molecular spectroscopy. Prerequisites: MATH 202, PHYS 202 and CHEM 213. Two lectures, one discussion and two laboratories.

**CHEM 353 Concepts of Physical Chemistry III (5)**

Introduction to elementary statistical thermodynamics, chemical kinetics and transport properties. Prerequisites: MATH 203, PHYS 203 and CHEM 213. Two lectures, one discussion and two laboratories.

**CHEM 390 Seminar in Chemical Literature (1)**

Seminar in the use of modern chemical literature and literature data bases. Must be completed before enrolling in CHEM 490.

**CHEM 400 Advanced Inorganic Chemistry (5)**

An analysis of the major theories of chemical bonding with particular emphasis on transition metal complexes. Structure, physicochemical properties and reactivity of classical metal complexes and organometallic compounds; mechanisms of inorganic reactions in aqueous and nonaqueous media. Prerequisite: CHEM 352 or consent of the instructor. Two lectures, one discussion and two laboratories.

**CHEM 440 Advanced Biochemistry (5)**

Principles underlying interactions of biological systems on the cellular, subcellular and molecular levels; membrane transport models, protein structure, function and kinetics. Prerequisites: CHEM 340 and CHEM 353 or consent of instructor. Two lectures, one discussion and two laboratories.

**CHEM 450 Instrumental Analysis (5)**

Principles and techniques of modern instrumental analysis including spectrophotometry, chromatography, nuclear magnetic resonance, and potentiometry. Prerequisite: CHEM 353 or consent of instructor. Two lecture, one discussion and two laboratories.

**CHEM 477 Special Topics in Chemistry (1-5)**

Topics and prerequisites to be announced. May be repeated for different topics.

**CHEM 480 Honors Research (5)**

Individual study on a current research problem with faculty supervision, preparation of a paper. Course may be repeated twice with permission of the instructor. Normally a maximum of five units may be used for major department credit. Units in excess of five may be used for upper division elective credit. Prerequisite: Invitation by faculty.

**CHEM 489 Experiential Prior Learning (1-5)**

Evaluation and assessment of learning which has occurred as a result of prior off-campus experience relevant to the curriculum of the department. Course may be repeated twice with permission of the instructor. Normally a maximum of five units may be used for major department credit. Units in excess of five may be used for upper-division elective credit. Available by petition only, on a credit, no-credit basis. Not open to postgraduate students. Interested students should contact the department office.

**CHEM 490 Senior Seminar (5)**

Presentation of papers and discussion on either one topic or a group of related topics by faculty and students. Five discussions. Prerequisite: Major or minor in chemistry and CHEM 390.

**CHEM 496 Internship in Chemistry (1-5)**

Students are assigned to various industries, institutions, or agencies and work under joint supervision of supervisors and the course instructor. Participation in staff and internship conferences. Assigned readings and projects where appropriate. (Arrangements should be made one quarter in advance with the department.) Course may be repeated twice with permission of instructor and department chair. Normally a maximum of six units may be used for major department credit. Units in excess of five may be used for upper division elective credit. Offered on a credit, no-credit basis only.

**CHEM 497 Cooperative Education (1-5)**

The Cooperative Education Program offers a sponsored learning experience in a work setting, integrated with a field analysis seminar. The field experience is contracted by the Cooperative Education Office on an individual basis, subject to approval by the department. The field experience, including the seminar and reading assignments, is supervised by the cooperative education coordinator and the faculty liaison (or course instructor) working with the field supervisor. Students are expected to enroll in the course for at least two quarters. The determination of course credits, evaluation, and grading are the responsibility of the departmental faculty. Offered on a credit, no-credit basis only. Department will determine application of credit.